HPNS Parcel F RAD DGI Status Update

Hunters Point Naval Shipyard

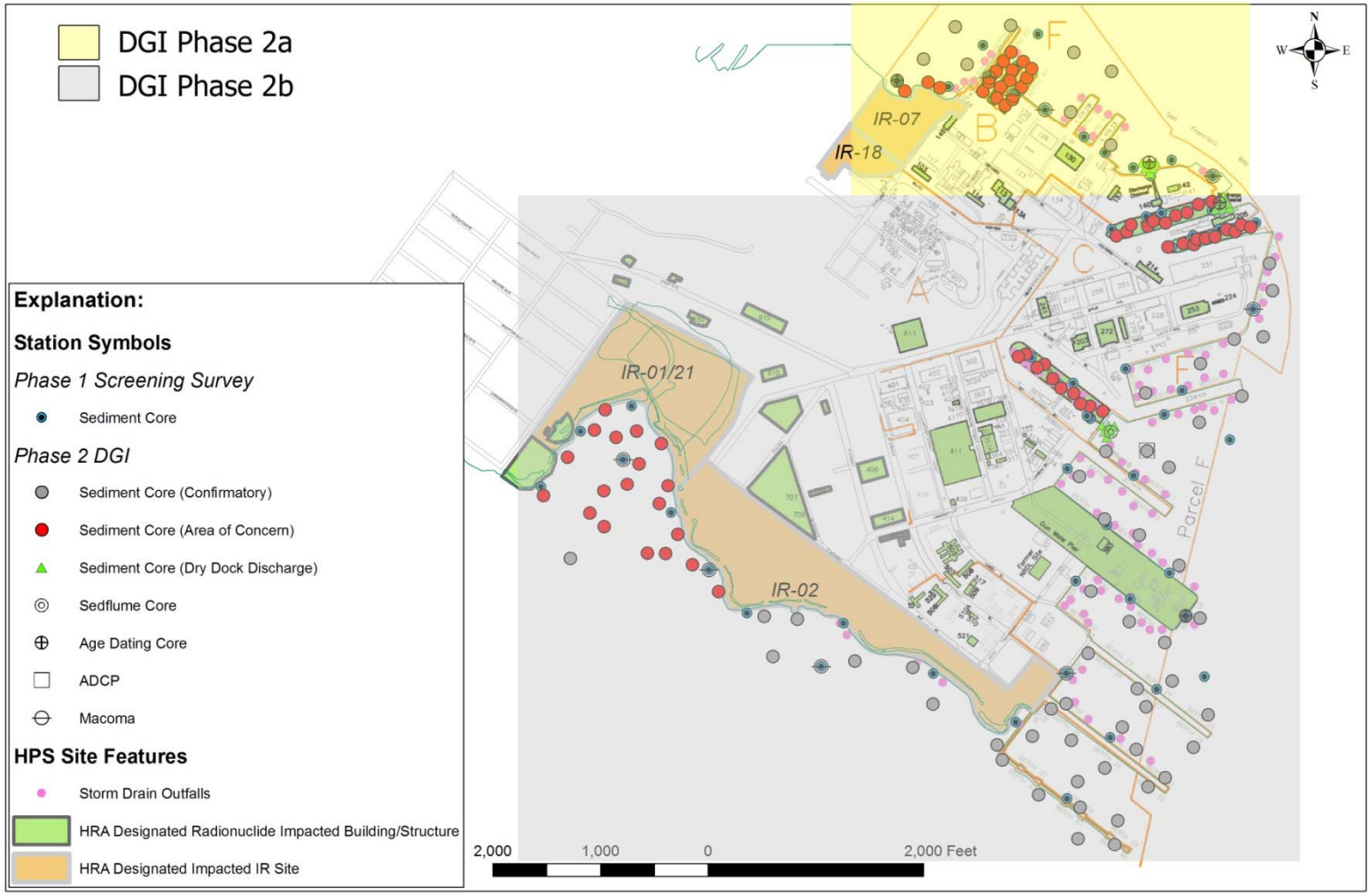
BCT Meeting

January 26, 2012

Project Review and Update

- Six Radionuclides of Concern (ROC) were identified for Parcel F based on the Historical Radiological Assessment (HRA; 2004): Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235
- Need for Data Gap Investigation (DGI) for ROCs throughout Parcel F and Radiological Addendum to Parcel F Feasibility Study
  - Review of DGI Approach
    - Due to limited historical data, DGI separated into three parts
    - Phase 1 - Initial Broad Scope Screening in 2009
      - Based on information provided in HPNS HRA (Navy 2004)
    - Phase 2a – Detailed Sampling Survey - Submarine Area and Parcel B Revetment Wall Area & 6 Reference locations
    - Phase 2b - Detailed Sampling Survey – Berths North, Berths South, South Basin

Parcel F RAD DGI Phase 2a & 2b Plan



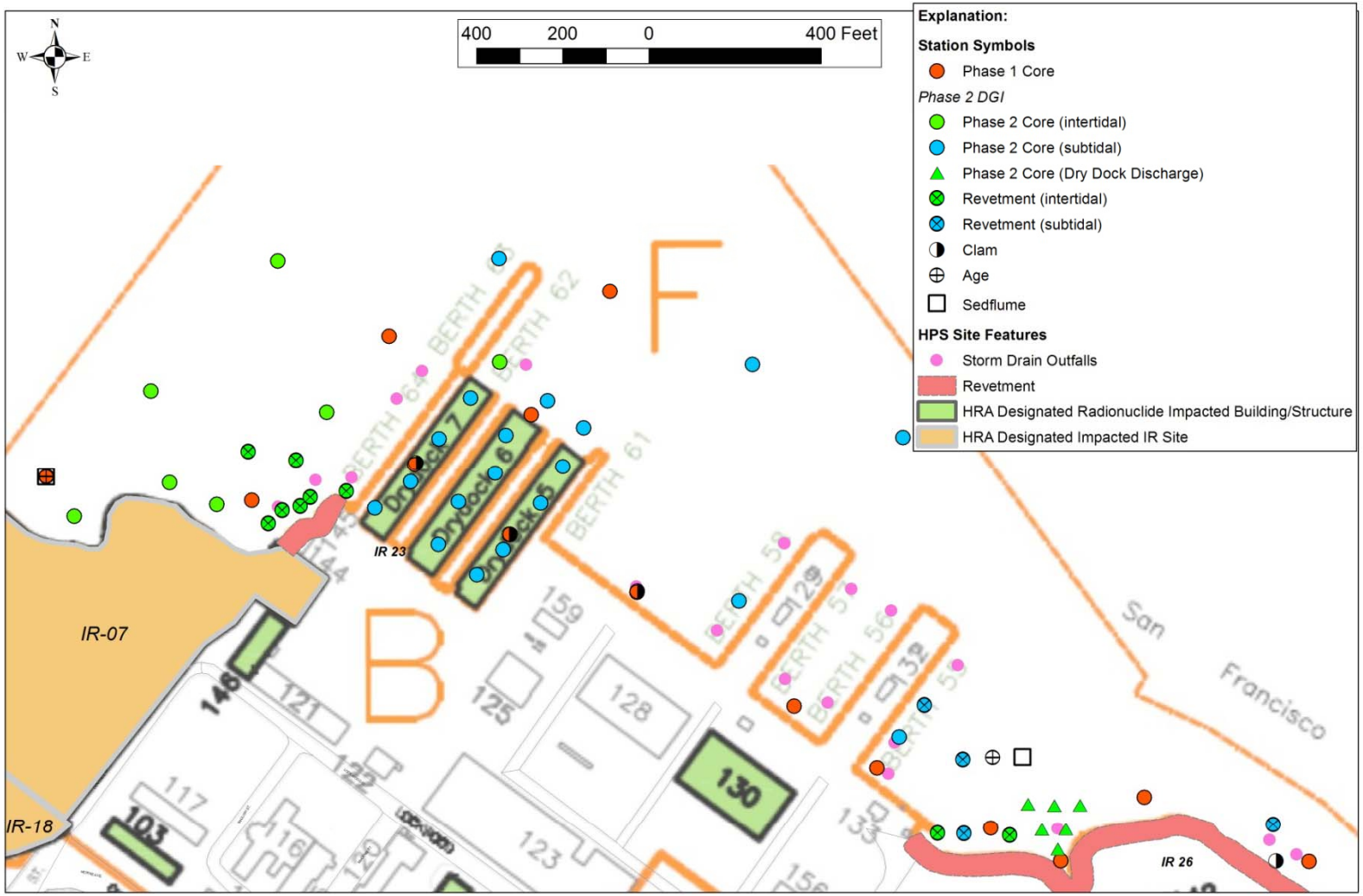
Project Review and Update

- DGI Phase 1 Screening Survey - 2009
- DGI Phase 2 Final Work Plan – August 2011
- DGI Phase 2a
  - Oct/Nov 2011: Collected 46 ROC Cores within Parcel F, 18 ROC cores at Reference sites
    - 4 ft cores segmented into one foot intervals (target of 4 samples/core)
    - Generated 169 Parcel F sediment samples and 69 Reference Samples (238 total samples)
      - (refusal limited some cores to <4 segments)
  - Collected 4 clam samples from Parcel F and 1 Reference clam sample
  - Collected 2 Sedflume and 2 age dating cores
  - Final Rad Data reports, data validation, and age dating results due in February.
  - Technical Memorandum in process; Draft - March 2012; Final - August 2012)
- DGI Phase 2b
  - Spring 2012: Collect 129 cores within Parcel F, 7 clam deployments, 3 Sedflume cores, 2 age dating cores, 1 water column velocity analysis
  - Prepare Tech Memo for Phase 2b: Draft - Aug 2012; Final - Jan 2013
- Radiological Addendum to Feasibility Study (FS)
  - Draft estimate date: January 2013
  - Final estimate date: July 2013

DGI Phase 2a/b Design Overview

- **Sediment cores collected and analyzed for ROC**
  - ROC results are compared against Project Action Limits (PALs) developed for three Conceptual Site Models (Intertidal, Subtidal, Revetment Wall)
- **Sediment dynamics**
  - Provide information about the fate and transport of sediment-bound radionuclides at the surface, identify areas of net sediment deposition and erosion, estimate rates of sediment accumulation where applicable, and predict the likelihood of subsurface sediment remobilization
    - **Sedflume** measurements are performed to determine sediment erosion rates which provide a quantitative measurement of sediment stability
    - **Age Dating** analyses are used to determine the age of sediments over years or decades
    - **Water Column Velocity** data are used to estimate potential for sediment resuspension and provide a baseline for extreme event analysis
- **Clam Tissue Bioaccumulation**
  - Levels of radionuclides in tissues with the potential for ingestion by wildlife and humans are estimated by deploying the clam *Macoma nasuta* in cages for >28 days

DGI Phase 2a: Submarine Area and Parcel B Revetment Wall Area Sampling Locations



Piston Core Sampling for ROC

Sampling vessel at submarine dry dock


Piston core processing


Piston core processing

DGI Phase 2a: Preliminary Subtidal CSM Results

Core Segments from Subtidal Locations Grouped (all samples and all depths included)

Radionuclide	Average[1] (pCi/g)	Stdv (pCi/g)	Min (pCi/g)	Max (pCi/g)	No. of Samples	PAL[2] (10-6 Risk)	Exceeds PAL? (Max Value)	% of PAL (pCi/g) (Max Value)
Co-60	0.0057	0.0213	-0.0623	0.0884	102	NA	NA	NA
Cs-137	0.1340	0.0619	0.0000	0.2450	102	425	No	0.06%
Pu-239/240	0.0107	0.0145	-0.0176	0.0547	95	68.2	No	0.08%
Ra-226	0.7466	0.2562	0.3200	1.8842	102	22.4	No	8.41%
Total Sr[3]	0.0638	0.1144	-0.1930	0.3100	91	9.93	No	3.12%
U-235	0.1399	0.1286	-0.1250	0.6970	102	178	No	0.39%

NA – Not Applicable. Co-60 PAL not created due to lack of presence in sediments and short half-life (5.3 years)

[1] Data from Phase 1 and Phase 2a Subtidal locations are combined in the analyses

[2] Preliminary Subtidal PALs developed in Phase 2 DGI Workplan (Battelle, 2011); PALs are for Recreational Shellfish Collection

[3] Total Sr includes Sr-90 plus additional Sr isotopes (conservative estimate of Sr-90)

Notes: PALs are not adjusted for background

DGI Phase 2a: Preliminary Revetment Wall CSM Results

Core Segments from Revetment Wall Locations Grouped (all samples and all depths included)

Radionuclide	Average[1] (pCi/g)	Stdv (pCi/g)	Min (pCi/g)	Max (pCi/g)	No. of Samples	PAL[1] (10^{-6} Risk)	Exceeds PAL? (Max Value)	% of PAL (pCi/g) (Max Value)
Co-60	-0.0007	0.0118	-0.0344	0.0336	62	NA	NA	NA
Cs-137	0.0839	0.0651	-0.0284	0.2480	62	724	No	0.03%
Pu-239/240	0.0091	0.0146	-0.0150	0.0547	49	129	No	0.04%
Ra-226	0.7969	0.3986	0.0463	2.4894	62	72.9	No	3.41%
Total Sr[3]	0.1306	0.1260	-0.1930	0.3700	48	381	No	0.10%
U-235	0.0997	0.0990	-0.1250	0.4050	62	338	No	0.12%

[1] Data from Phase 1 and Phase 2a Revetment Wall locations are combined in the analyses

[2] Preliminary Revetment Wall PALs developed in Phase 2 DGI Workplan (Battelle, 2011); PALs are for Adult Recreational Fisherman

[3] Total Sr includes Sr-90 plus additional Sr isotopes (conservative estimate of Sr-90)

Notes: PALs are not adjusted for background here

DGI Phase 2a: Preliminary Intertidal CSM Results for Five ROC (Co-60, Cs-137, Pu-239, Sr-90, U-235)

Core Segments from Intertidal Locations Grouped (all samples and all depths included)

Radionuclide	Average[1] (pCi/g)	Stdv (pCi/g)	Min (pCi/g)	Max (pCi/g)	No. of Samples	PAL[2] (10^{-6} Risk)	Exceeds PAL? (Max Value)	% of PAL (pCi/g) (Max Value)
Co-60	-0.0004	0.0142	-0.0364	0.0622	105	NA	NA	NA
Cs-137	0.0841	0.0632	-0.0284	0.2480	105	1.28	No	19.4%
Pu-239/240	0.0058	0.0123	-0.0199	0.0422	84	67.8	No	0.1%
Total Sr[3]	0.1831	0.5118	-0.1930	4.5600	79	9.37	No	48.7%
U-235	0.1156	0.1102	-0.1020	0.6720	105	4.22	No	15.9%

NA – Not Applicable. Co-60 PAL not created due to lack of presence in sediments and short half-life (5.3 years)

[1] Data from Phase 1 and Phase 2a Intertidal locations are combined in the analyses

[2] Preliminary Intertidal PALs developed in Phase 2 DGI Workplan (Battelle, 2011); PALs are for Recreational Shellfish Collection

[3] Total Sr includes Sr-90 plus additional Sr isotopes (conservative estimate of Sr-90)

Notes: PALs are not adjusted for background

DGI Phase 2a: Preliminary Intertidal CSM Results for Ra-226

Ra-226 Data Summary
Core Segments from Intertidal Locations Grouped (all samples and all depths included)

Radionuclide	Average[1] (pCi/g)	Stdv (pCi/g)	Min (pCi/g)	Max (pCi/g)	No. of Samples	PAL[2] (10^{-6} Risk)	Exceeds PAL? (Max Value)	% of PAL (pCi/g) (Max Value)
Ra-226	0.7333	0.3716	0.0463	2.4894	105	1.6 [3]	Yes	156%

Ra-226 Sample Information for 3 Samples Collected Exceeding Intertidal PAL

Location	Result (pCi/g)	Core Segment	PAL[2] (10^{-6} Risk)	Exceeds PAL? (Max Value)	% of PAL (pCi/g) (Max Value)
BN01	2.4894	1-2ft	1.6 [3]	Yes	156%
SA05	2.2391	0-1ft	1.6 [3]	Yes	140%
SA01	1.8229	2-3ft	1.6 [3]	Yes	114%

[1] Data from Phase 1 and Phase 2a Intertidal locations are combined in the analyses

[2] Preliminary Intertidal PALs developed in Phase 2 DGI Workplan (Battelle, 2011); PALs are for Recreational Shellfish Collection

[3] Preliminary SF Bay background level of Radium = 0.6 pCi/g; Radium PAL = 1.6 pCi/g (1.0 pCi/g over background)

Note: All three samples that exceed PAL were collected in Phase 1 and analyzed at the NWT Onsite Lab.

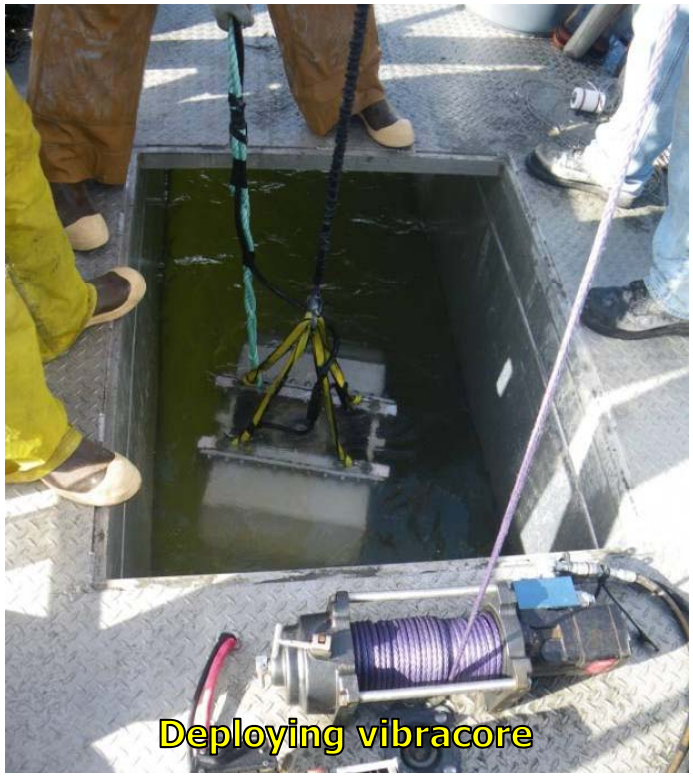
DGI Phase 2a: Intertidal CSM Ra-226 PAL Exceedances

- Ra-226 PAL Exceedances: Three samples out of 105 Intertidal CSM samples exceeded Ra-226 PAL of 1.6 pCi/g
  - SA01 (1.8229 pCi/g; 2-3')
  - SA05 (2.2391 pCi/g; 0-1')
  - BN01 (2.4894 pCi/g; 1-2')

DGI Phase 2a/b Reference Locations

- 6 Reference locations were used based on the following rationale:
  - Five historical locations
    - Red Rock; Paradise Cove; Alcatraz; Alameda Buoy; Bay Farm
    - Locations used in environmental studies for Navy and other regulatory programs in San Francisco Bay (i.e., historical precedence)
    - Locations used in previous Parcel F studies
    - Sediments have similar range of physical characteristics as HPNS sediments
    - Sediments are representative of SF Bay regional ambient conditions (i.e., not considered influenced by nearby point sources of contamination)
    - Proximity to HPS
  - One new location
    - Oyster Point
    - Established in the DGI Phase 1

Vibracore Sampling at Reference Areas



Electric Vibracore used at 5/6 Reference Areas due to water depths exceeding Piston Core System capabilities (~20ft max)

Piston core system used at Oyster Point Reference Area

DGI Phase 2a: Preliminary Reference Site Results

Core Segments from Reference Site Locations Grouped (all samples and all depths included)

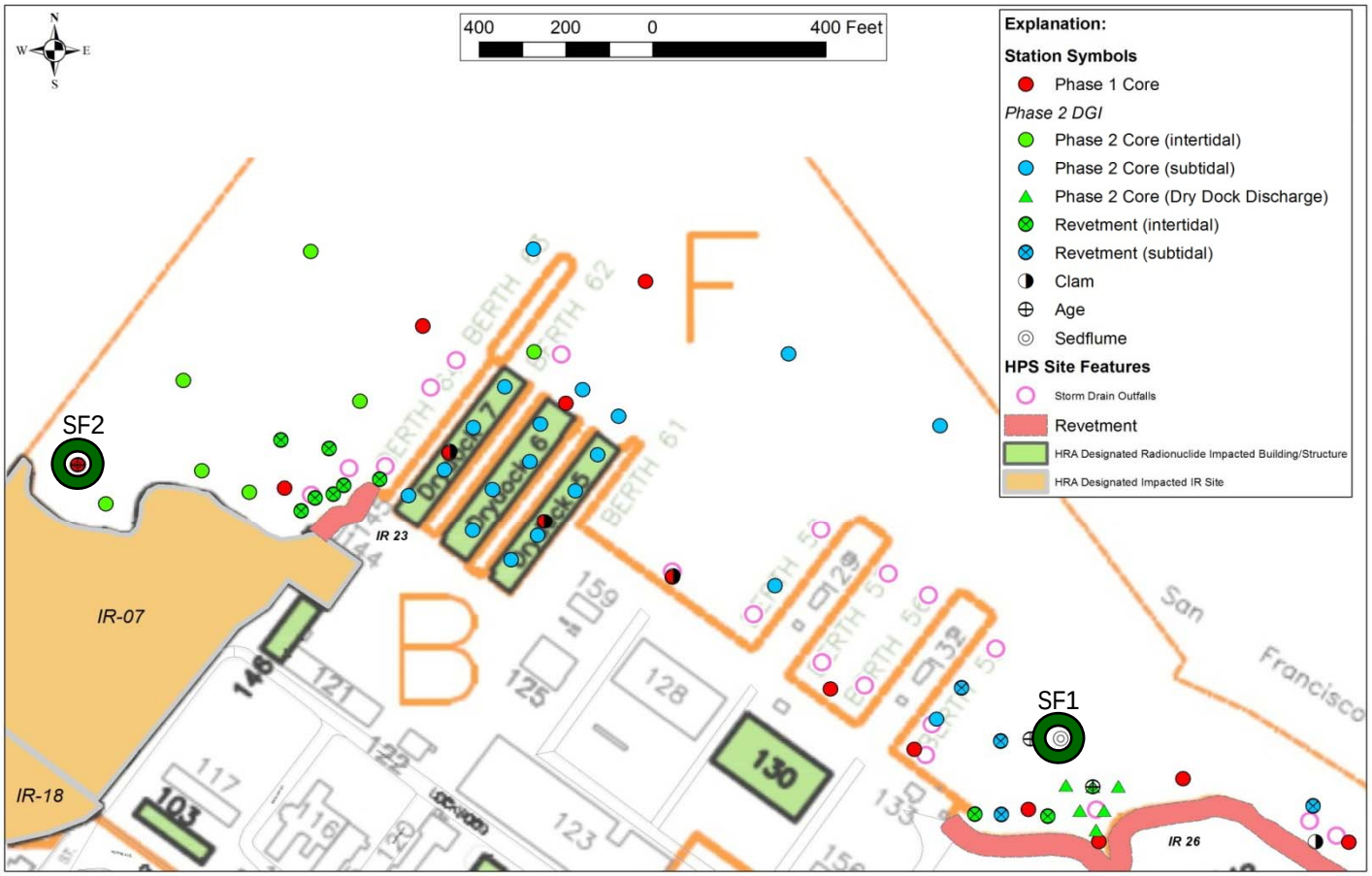
Radionuclide	Average[1] (pCi/g)	Stdv (pCi/g)	Min (pCi/g)	Max (pCi/g)	Location of Max Result	Segment interval of Max Result	No. of Samples
Co-60	0.0065	0.0184	-0.0317	0.1030	PC	2-3ft	69
Cs-137	0.0554	0.0711	-0.0405	0.2130	BF	1-2ft	69
Pu-239/240	0.0048	0.0130	-0.0167	0.0527	BF	2-3ft	69
Ra-226	0.6039	0.1601	0.2120	0.9940	AB	3-4ft	69
Total Sr	0.0801	0.0946	-0.1560	0.2990	BF	1-2ft	69
U-235	0.1726	0.1436	-0.0079	0.6220	PC	1-2ft	69

[1] Data only from Phase 2a

PC = Paradise Cove; AB = Alameda Buoy; BF = Bay Farm

Note: No Max results from Red Rock, Alcatraz, or Oyster Point (results less than PC, AB, & BF)

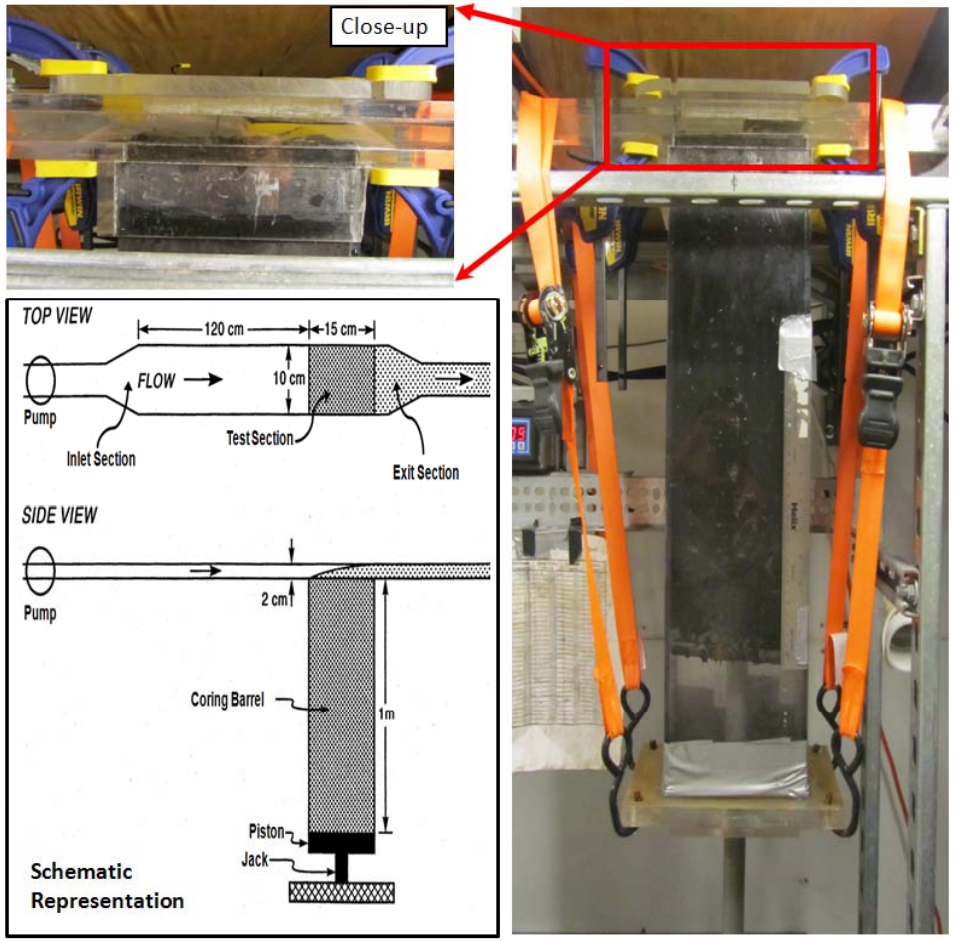
DGI Phase 2a: Sedflume Sampling



Sedflume location – Phase 2a

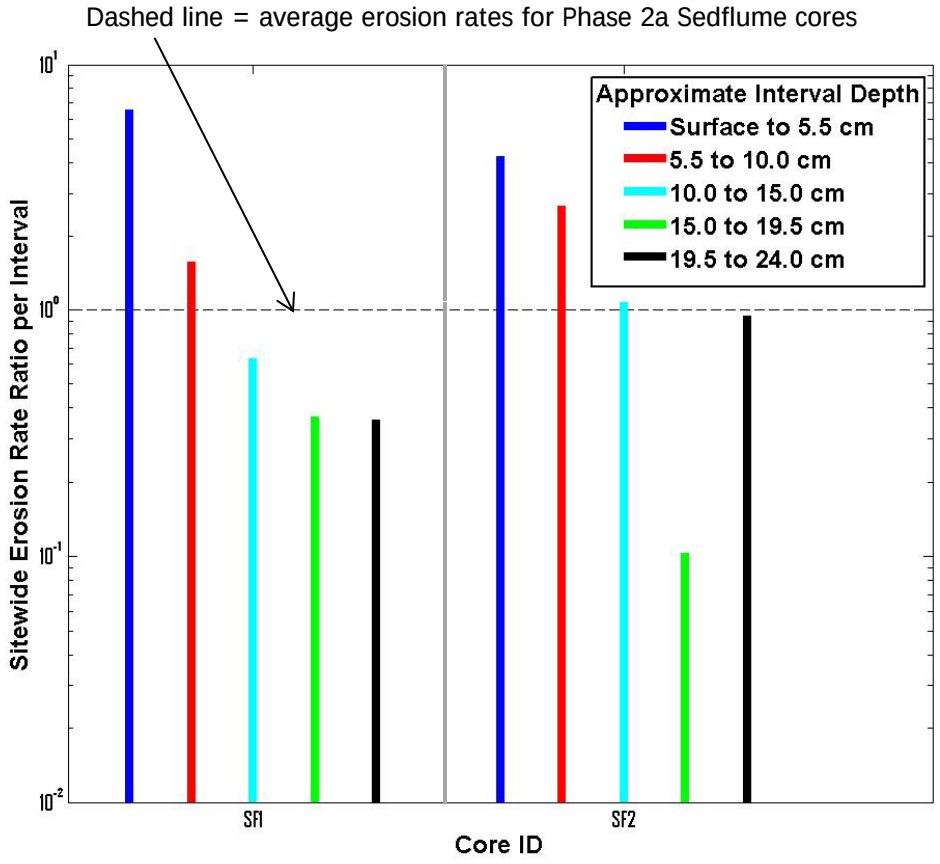
Sedflume Core Sampling

Sedflume core



Sedflume core processing schematic

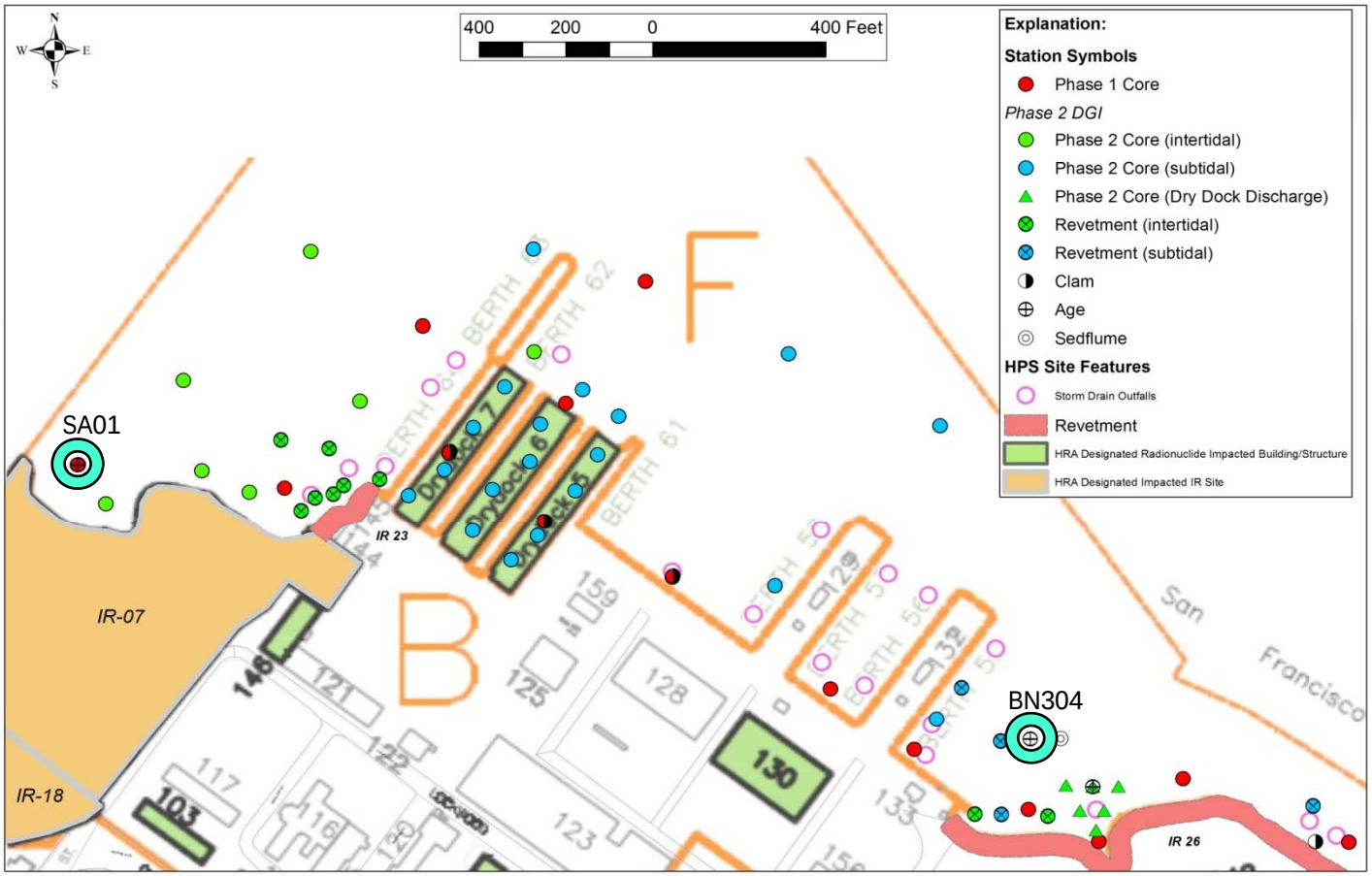
DGI Phase 2a: Sedflume Results



Erosion rates by interval for two Phase 2a Cores

- Measurement of sediment erosion rates via Sedflume provides a quantitative measurement of sediment stability that can be used to determine the potential for sediment mobility
- Two cores were collected from shallow subtidal locations at Parcel F (2.2 and 3.5 ft MLLW)
- Mean erosion rates of each core were nearly identical
- Both Phase 2a cores showed decreasing erosion rates (increasing sediment stability) with depth consistent with normally consolidating undisturbed sediments
  - Lowest interval in SF2 produced higher erosion rate due to loose organic material
- Modeling of sediment transport awaiting data from age cores (Phase 2a) and water column velocity (Phase 2b)

DGI Phase 2a: Age Dating Core Sampling



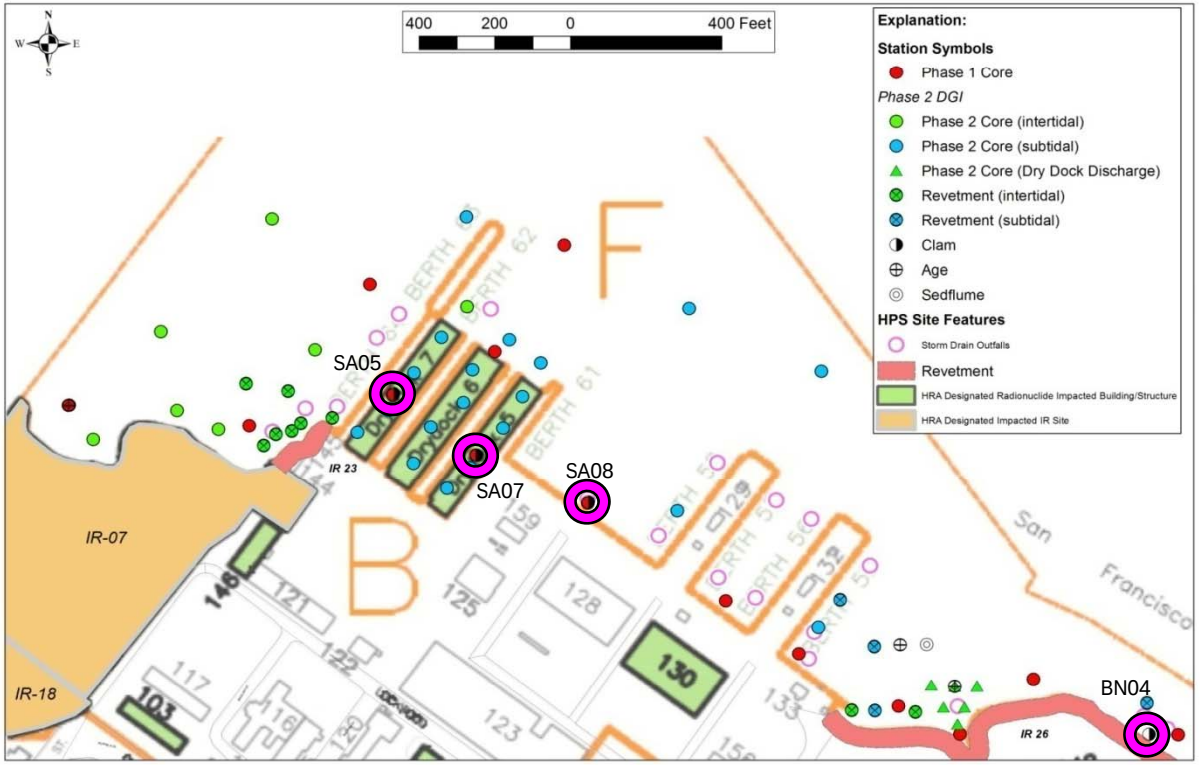
Age Dating Core location – Phase 2a

DGI Phase 2a: Age Dating Sampling

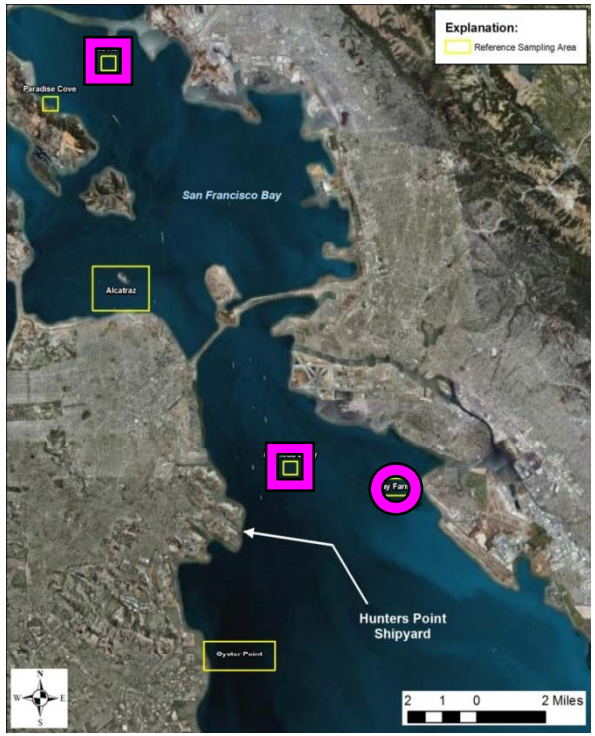
- Age Dating data are used to determine the age of sediments over years or decades
  - Primary radionuclide markers
    - » Pb-210, Ra-226
  - Secondary radionuclide markers
    - » Be-7, Cs-137, Th-234,
- Cores were collected from two locations within Parcel F for age dating
  - SA01 and BN304
  - Four foot (~120 cm long) cores
  - Cores segmented into ~2cm sections
    - ~60 sections per core
  - Sections analyzed for radionuclide markers and determination of geochronology. Will receive results in February 2012.

DGI Phase 2a: Clam Deployments

Parcel F Clam Deployment Locations



Reference Area Clam Deployment Locations



Successful clam deployment location – Phase 2a

Unsuccessful clam deployment location (cages lost) – Phase 2a

Notes: No tissue samples exceeded PALs for tissue consumption

Sample deployment locations at Parcel determined from Phase 1 sediment data

DGI Phase 2a: Tissue Sampling Summary

- **Clam (*Macoma nasuta*) tissue bioaccumulation sampling**
  - Deployed clams for tissue bioaccumulation exposure at seven locations
    - Four locations at Parcel F (SA05, SA07, SA08, BN04)
    - Three reference locations (Red Rock, Alameda Buoy, Bay Farm)
    - 3 cages of clams deployed at each location
    - Collected 13 surface sediment samples from sediment placed in cages at time of deployment to determine dose of radionuclides to clams
      - 4 sediment samples from Parcel F
        - » 1 sediment sample composited from 3 clam cages at each of the four deployment locations
      - 9 sediment samples from the 3 Reference Areas
        - » 1 sediment sample for each of the 9 clam cages
  - Recovered clams from five of seven locations
    - Recovered clams from all four Parcel F deployments
    - Recovered clams from Bay Farm. Red Rock and Alameda Buoy cages lost
    - Deployments ranged from 31-36 days

Clam Cage Deployment


Sediment collection van-veen grab


Clams in cage w/sediment


Deploying clam cage

DGI Phase 2a: Clam Tissue Summary

Radionuclide	Hunters Point - Four Samples (pCi/g)			Reference One Sample (pCi/g)	PAL[1]	Exceeds PAL? (Max Value)	% of PAL (Max Value)
	Average	Min	Max				
Co-60	-0.00267	-0.01130	0.00647	0.00630	NA	NA	NA
Cs-137	0.00974	-0.00017	0.01780	0.00543	24.2	No	0.074%
Pu-239/240	0.00282	-0.00891	0.01210	-0.00284	4.32	No	0.28%
Ra-226 – Alpha	0.02692	-0.01610	0.11000	0.01990	2.53	No	4.35%
Ra-226 – Gamma	-0.05145	-0.06150	-0.04280	-0.01150	2.53	No	-1.69%
Sr-90	0.01010	-0.01880	0.04360	-0.00860	12.7	No	0.34%
U-235 – Alpha	0.00099	0.00060	0.00144	0.00062	11.3	No	0.013%
U-235 - Gamma	-0.00055	-0.02980	0.03450	-0.04510	11.3	No	0.31%

[1] Preliminary Clam Tissue Consumption PALs developed as part of the Draft Technical Memorandum, in process

DGI Phase 2a: ROC Results to Date Summary

- Sediment ROC Summary
  - Subtidal CSM: No PAL Exceedances (all Six ROC)
  - Revetment Wall CSM: No PAL Exceedances (all Six ROC)
  - Intertidal CSM
    - No PAL Exceedances for Co-60, Cs-137, Pu-239/240, Sr-90, & U-235
    - 3 PAL Exceedances for Ra-226 (Intertidal Preliminary PAL = 1.6 pCi/g)
      - SA01 (1.8229 pCi/g at 2-3'); SA05 (2.2391 pCi/g at 0-1'); BN01 (2.4894 pCi/g at 1-2')
- Bioaccumulation (clam tissue) ROC Summary
  - No PAL Exceedances (all Six ROC)
- Next Steps
  - Discuss all data in the upcoming Technical Memorandum (Draft: March 27, 2012; Final: August 1, 2012)
  - Address PAL exceedances in the Parcel F FS RAD Addendum (Draft: January 2013; Final: July 2013)

Project Schedule

Task	Start Date	End Date
DGI Phase 2a		
Draft Phase 2a Technical Memorandum	19-Dec-2011	27-Mar-2012
Draft Final Phase 2a Technical Memorandum	11-May-2012	22-Jun-2012
Final Phase 2a Technical Memorandum	11-Jul-2012	1-Aug-2012
DGI Phase 2b		
Phase 2b Field Survey	17-Apr-2012	25-May-2012
Draft Phase 2b Technical Memorandum	31-Jul-2012	29-Aug-2012
Draft Final Phase 2b Technical Memorandum	17-Oct-2012	28-Nov-2012
Final Phase 2b Technical Memorandum	18-Dec-2012	11-Jan-2013
Radiological Addendum to Feasibility Study	8-Oct-2012	5-Jul-2013